graphically many of the properties of a train of lenses, especially points of magnification and aperture, but it must be used discreetly. The author has himself been betrayed into an erroneous conclusion by means of it. If the origin of such a catena is a point of light, and a small opaque disc is inserted in the opening limb, the lane of darkness succeeding it will follow the same rules of formation as the cone of light, *i.e.* it will be a succession of cones having bases at the apertures and vertices at the images. One base is the conical projection merely of the previous one. Now Sir A. E. Wright is rather prone to overrate the resemblance between projections and images. He calls the similitude of a candle shining through a small hole upon a screen an image. That is not the sense in which the word is technically employed. An image is always a focussed image, though the qualification is not invariably stated. But the confusion of the two ideas leads the author into language which cannot be interpreted otherwise, we think, than as implying that every detail in one aperture, say a fleck of dust, is repeated as a genuinely focussed image situated at succeeding apertures. It is only a projection that takes place in such a case, and it would occur equally well at any plane along the line; and when the source of light has finite dimensions, even this strictly defined projection will not occur. This idea that everything in one aperture is *focussed* in succeeding apertures leads the author to more than one conclusion which, if we read him aright, is not sound.

An example of error arising really from the neglect of the focussing idea occurs in the author's justification, for it is not a proof, of the expression for the numerical aperture, in so far as it increases with the index of refraction of the external medium. In one of the diagrams (p. 74) the final surface of a convex lens is drawn as a plane, and in that case the excentric ray of a convergent beam will not intersect the axis, if it finds itself in water or in oil, at a point so close to the lens as if air were the medium in which it emerges. That is true, but it is no proof or even illustration of the point under consideration, which is the effect of the index upon the numerical aperture. This will be manifest by supposing the lens a convex meniscus with the second surface concave, and the origin of light to be at the point which is conjugate to the centre of curvature of the second surface. Then the light, both immediately before and after encountering the final face, will be normal to it, and an emergent ray will intersect the axis at the same point whether the surrounding medium be air or water. But the numerical aperture would still be affected by the medium.

The aperture question seems, indeed, a stumbling-block to the author. He knows as well as others do the connection between the radius of the false disc and the numerical aperture, and he rightly defines the latter, but his proof of the proposition at pp. 110, 111, would make the numerical aperture proportional to the tangent (instead of the sine) of the semi-angle of the cone of light.

The author has constructed an instrument to which he has given the name eikonometer, not a very happy one, for its object is, not to measure images generally, but by measuring certain images to arrive at magnifying powers. The principle, which is not so new as the author supposes, any more than the constructed instrument, is the fact that if two lenses are placed upon the same axis at any convenient distance apart, the first principal focus of one is conjugate to the second principal focus of the other, and the object bears to the image the same linear proportion which the focal lengths of the two lenses bear one to the other. Hence, if the object be of known dimensions, and its image be measured and therefore also known, and if one of the focal lengths be known, the other is also at once determinable. The actual focal length of an entire microscope may thus be, and has been, determined in one observation. The magnifying power is usually taken as the number resulting from the division of 250 by the focal length in millimetres, but this is an arbitrary rule which presupposes that 250 millimetres is the least distance of distinct vision, which is certainly not the case universally. The author does not use the eikonometer quite logically. In finding the focal length of a microscope his instruction is, *first* to focus the microscope in the usual way upon a scale of known dimensions situated on the stage, then to place the eikonometer over the eye end of the instrument and to read off.

The instruction should be *first* to place the eikonometer in position, and *then* by means of the ordinary focussing arrangement of the microscope bring the image of the scale on the stage into position at the scale of the eikonometer, and then read off.

The author thinks himself at issue with Abbe in the conclusion drawn from the grating experiment of the latter. This arises through a misapprehension, and the experiments which the author cites do not affect the conclusions which Abbe reached.

THOMAS H. BLAKESLEY.

THE CRUSTACEA OF DEVON AND CORNWALL.

The Crustacea of Devon and Cornwall. By Canon A. M. Norman, F.R.S., and Dr. Thomas Scott. Pp. xv+232; 24 plates. (London: William Wesley and Son, 1906.) Price 1*l.* 4*s.* net.

STUDENTS of British carcinology owe their thanks to Dr. Norman and Dr. Scott for the first appearance of a volume embracing the wide field of our indigenous crustacean fauna, as hitherto recorded in the Devon and Cornwall area. Dr. Norman's researches in this district, extending over a period of more than fifty years, are too well known to need mention here, and the publication of his records is a welcome addition to our literature. The introduction contains some interesting comparative tables on the distribution of species north and south relative to the area with which the work is concerned. The body of the work comprises an enumer-

ation of the species, with synonymy and records of occurrence, and occasional descriptive notes, with twenty-four plates.

The laborious task involved in gathering together the extant records of those who have in past years contributed to our knowledge of the British Crustacea must not be underestimated; but it is much to be regretted that the authors did not at the outset, in the compilation of such a work, bear in mind more fully the need of the student to whom, if not already an expert, a mere enumeration of our crustacean fauna can be of little assistance in his work. We would much have wished that the authors, with their wide knowledge of the group, had seen well to combine with their work a system of synoptic tabulation, whereby the volume might have been made of more practical service to the student. The portion dealing with the Copepoda bears witness to the extreme care bestowed on this part of the work. Records of occurrence are given in interesting detail throughout, and the many new species for the discovery of which we are indebted to the authors are very fully described, their distinctive characters being well exhibited in the accompanying plates. We would wish that the same careful system had been followed throughout the remainder of the volume, where records of observation are very bare and indefinite, rarely with dates, and distinctive characters are for the most part entirely omitted. There seems, for example, no reason why two succeeding species of Galathea should be dismissed with the bare entry "common," or why, at the opening page, the three species of Ebalia should be passed over without comment, despite the precarious identity of one of them, which some of us still hope to retain.

The retention of errors like "Daphina" (p. 102), "Reptort" (p. 185), and two authors' names, in a footnote to p. 202, both of them mis-spelt, is a disfigurement to the text. *Squalus galeus* and *S. acanthias* (p. 74) are inconsistent with *Galeus vulgaris* and *Acanthias vulgaris* elsewhere. "Whiting-pout (*Gadus fuscus*)," on p. 216, is misleading. On p. 192, for the host of *Asterocheres suberitis* the name *Suberites domuncula* is employed, a sponge which, properly named, does not, so far as we know at present, exist in our fauna.

Including eighty-six inland forms, 808 species of Crustacea are recorded for the area concerned, the marine Copepoda and Amphipoda numbering 274 and 142 respectively. As compared with these figures, Dr. Scott has previously recorded for the Clyde district 855 species, the Sympoda, Amphipoda, and Ostracoda being responsible for the difference.

While feeling a certain sense of disappointment at the general scheme of the work, we are much indebted to the authors for placing at our disposal a valuable record of observation which it is hoped may some day contribute largely to the drawing up of that much-needed work, a handbook to the British Crustacea.

L. R. C.

PALÆONTOLOGY FOR STUDENTS.

Die Leitfossilien aus dem Pflanzen- und Thierreich in systematischer Anordnung. By Dr. Johannes Felix. Pp. x+240; illustrated. (Leipzig: Veit and Co., 1906.) Price 6 marks.

SINCE the publication of the late Prof. Karl von Zittel's exhaustive "Handbook of Palæontology," several smaller books have been compiled on the same plan. The encyclopædic method, which is appropriate enough for a large work of reference, has been adopted in the less pretentious text-books for the use of elementary students who desire only a general acquaintance with fossils. The result is that instead of teaching fundamental principles and broad outlines, these little books provide an overwhelming series of disconnected facts which weary the memory, and palæontology is not only discredited as a mental exercise, but also becomes unpopular with those who really need its guidance while pursuing allied branches of science.

Another of these small books has just been laboriously compiled, with numerous illustrative figures, by Dr. Johannes Felix, the well-known palæontologist of Leipzig. It is neither better nor worse than its predecessors, and illustrates well the disadvantages of the dictionary form for elementary teaching. For instance, among Carboniferous plants, one of the most important groups is that of the Pteridosperms, bearing well-developed seeds in association with fern-like foliage. Dr. Felix's brief catalogue may enable a student to distinguish a Neuropteris from a Pecopteris, and so forth, but it does not give the least clue to the real interest or meaning of these fossils. Again, among vertebrate animals, the theromorphous reptiles are of fundamental value as pointing out the direction in which the cold-blooded land animals passed into the warm-blooded mammals. The book before us, though pretending to deal with fossils at varying lengths according to their degree of importance, does not even mention that the Theromorphs were chiefly land animals. It merely catalogues, with a desultory statement, the skull of the sea-reptile Placodus, which is probably not a Theromorph at all, and certainly gives no conception of the nature of the group in question.

Still worse, this compilation and condensation of matter from previous text-books destroys all effort to bring the subject up to date. It is much simpler to select a few miscellaneous facts from an exhaustive collection, and to purchase a set of electrotypes in a wholesale manner, than to make a judicious use of original memoirs and prepare new drawings to illustrate the science as it is now understood. We therefore look in vain among the "Leitfossilien" enumerated by Dr. Felix for any allusion to the European Lower Palæozoic fishes, the South African Triassic reptiles, the Egyptian Tertiary mammals, and the remarkable discoveries in South America, which have revolutionised many ideas in palæontology during the past two decades. Students may be able to name a few common European fossils if they happen to have